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Counting Messages of Quantum Sources

We study the number of typical messages that can be emitted by a quantum source, hoping to find a fundamental connection to the von Neumann entropy. We focus attention to the linear independence in a given set of quantum messages. We approached this problem by studying the spectrum of Gram matrices that are constructed using the set of messages. We will use this method to study the number of typical messages of quantum sources that are only able to emit two qubits and try to relate it to the entropy. Next, we also examine the number of typical messages of more general sources that emit states which are uniformly distributed. In this case the Gram matrices are random matrices and we will explore their eigenvalue distribution. Finally we reach the conjecture that this eigenvalue distribution is a Marchenko-Pastur distribution.